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Comparative effectiveness of endovascular versus open repair of ruptured abdominal aortic aneurysm in the Medicare population

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Objective: Endovascular aortic repair (EVAR) for abdominal aortic aneurysm (AAA) is increasingly used for emergent treatment of ruptured AAA (rAAA). We sought to compare the perioperative and long-term mortality, procedure-related complications, and rates of reintervention of EVAR vs open aortic repair of rAAA in Medicare beneficiaries.

Methods: We examined perioperative and long-term mortality and complications after EVAR or open aortic repair performed for rAAA in all traditional Medicare beneficiaries discharged from a United States hospital from 2001 to 2008. Patients were matched by propensity score on baseline demographics, coexisting conditions, admission source, and hospital volume of rAAA repair. Sensitivity analyses were performed to evaluate the effect of bias that might have resulted from unmeasured confounders.

Results: Of 10,998 patients with repaired rAAA, 1126 underwent EVAR and 9872 underwent open repair. Propensity score matching yielded 1099 patient pairs. The average age was 78 years, and 72.4% were male. Perioperative mortality was 33.8% for EVAR and 47.7% for open repair ($P <$ .001), and this difference persisted for >4 years. At 36 months, EVAR patients had higher rates of AAA-related reinterventions than open repair patients (endovascular reintervention, 10.9% vs 1.5%; $P <$ .001), whereas open patients had more laparotomy-related complications (incisional hernia repair, 1.8% vs 6.2%; $P <$ .001; all surgical complications, 4.4% vs 9.1%; $P <$ .001). Use of EVAR for rAAA increased from 6% of cases in 2001 to 31% in 2008, whereas during the same interval, overall 30-day mortality for admission for rAAA, regardless of treatment, decreased from 55.8% to 50.9%.

Conclusions: EVAR for rAAA is associated with lower perioperative and long-term mortality in Medicare beneficiaries. Increasing adoption of EVAR for rAAA is associated with an overall decrease in mortality of patients hospitalized for rAAA during the last decade.

A single-center experience of aneurysms in abdominal organ transplant recipients

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Objective: The purpose of this study was to characterize the prevalence and natural history of aneurysms among abdominal transplant recipients.

Methods: This article is a retrospective review of adult patients who underwent a kidney or liver transplant at a single center between February 23, 2000, and October 6, 2011. Data were obtained by searching electronic medical records for documentation of arterial aneurysm. Abdominal aortic aneurysms (AAAs) were included if they were $\geq$3.0 cm in diameter, and thoracic aortic aneurysms were included if they had a diameter $\geq$3.75 cm. Additional data collected included recipient demographics, transplant-specific data, and characteristics of the aneurysms.

Results: There were 927 liver transplant recipients, 2133 kidney transplant recipients, 23 liver-kidney transplant recipients, and 133 kidney-pancreas transplant recipients included in our study; 127 of these patients were identified to have aneurysms (40 liver, 83 kidney, 3 liver-kidney, 1 kidney-pancreas). The overall prevalence of any aneurysm was similar for liver and kidney recipients, but the distribution of aneurysm types was different for the two groups. AAAs made up 29.6% of aneurysms in kidney transplant recipients and 11.4% of aneurysms in liver transplant recipients (P = .02). Visceral aneurysms were 10-fold as common in liver transplant recipients compared with kidney transplant recipients (47.7% of aneurysms vs 5.1% of aneurysms; $P <$ .01). The majority of visceral artery aneurysms involved the hepatic and splenic artery. For both liver and kidney transplant recipients, most aneurysms occurred post-transplantation. All known aortic aneurysm ruptures occurred post-transplantation (25% of AAAs in liver transplant patients and 22.2% of thoracic aortic aneurysms in kidney transplant patients). There was a trend toward higher AAA expansion rates after transplantation (0.58 ± 0.48 cm/y compared with 0.41 ± 0.16 cm/y).

Conclusions: Compared with the general population, aneurysms may be more common and may have an aggressive natural history in abdominal transplant recipients. Furthermore, the types of aneurysms that affect liver and kidney transplant recipients differ. Care teams should be aware of these risks and surveillance programs should be tailored appropriately.

Decision analysis model of open repair versus endovascular treatment in patients with asymptomatic popliteal artery aneurysms

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Objective: Repair is indicated of asymptomatic popliteal artery aneurysms (aPAAs) that are >2 cm. Endovascular PAA

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repair with covered stents (stenting) is increasingly used. It is, however, unclear when an endovascular approach is preferred to traditional open repair with great saphenous vein bypass (GSVB). The goal of this study was to assess the treatment options for aPAAs using decision analysis.

Methods: A Markov model was developed and a hypothetic cohort of patients with aPAAs was analyzed. GSVB, stenting, and nonoperative management with optimal medical treatment (OMT) were compared. Operative mortality, patency rates, quality-of-life values, and costs were determined by comprehensive review of the best available evidence. The main outcome was quality-adjusted life-years (QALYs). Secondary outcomes were cost-effectiveness and number of reinterventions.

Results: For a 65-year-old male patient with a 2.0-cm aPAA and without significant comorbidities, probabilistic sensitivity analysis shows that intervention is preferred over OMT (5.77 QALYs, 95% credibility interval [CI], 5.43-6.11; OMT). GSVB treatment for this patient results in slightly higher QALYs than stent placement, with a predicted 8.43 QALYs (GSVB: 95% CI, 8.21-8.64) vs 8.07 QALYs (stenting: 95% CI, 7.84-8.29), a difference of 0.36 QALYs (95% CI, 0.14-0.58). Furthermore, costs are higher for stenting ($40,464; 95% CI, $34,814-$46,242) vs GSVB ($21,618; 95% CI, $15,932-$28,070), and more reinterventions are required after stenting (1.03 per patient) vs GSVB (0.52 per patient), making GSVB the preferred strategy for all outcomes considered. Stenting is preferred in patients who are at high risk for open repair (>6% 30-day mortality) or if the 5-year primary patency rates of stenting increase to 80%. For very old patients (>95 years) and patients with a very short life expectancy (<1.5 years), OMT yields higher QALYs.

Conclusions: GSVB is the preferred treatment in 65-year-old patients with aPAAs for all outcomes considered. However, patients at high risk for open repair or without suitable vein should be considered as candidates for endovascular repair. Very elderly patients and patients with a short life expectancy are best treated with OMT. Further improvement of endovascular techniques that increase patency rates of endovascular stents could make this the preferred therapy for more patients in the future.

Lower extremity arterial reconstruction for critical limb ischemia in diabetes

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Background: The impact of diabetes mellitus on the technical and clinical outcomes of infrainguinal arterial reconstruction (IAR) for critical limb ischemia (CLI) remains controversial. This study analyzed the outcome of IAR in diabetic patients with CLI over a 17-year period.

Methods: Details on all consecutive patients undergoing primary IAR at our institution were stored prospectively in a vascular registry from 1995 to 2011. Demographics, risk factors, indications for surgery, inflow sources and outflow target vessels, types of conduit, and adverse outcomes were analyzed. Postoperative surveillance included clinical examination, duplex scans, and ankle-brachial index measurements in all patients at discharge, 1 and 6 months after surgery, and every 6 months thereafter. End points were patency, limb salvage, survival, and amputation-free survival rates, and were assessed using Kaplan-Meier life-table analysis. The χ^2 or Fisher exact, Student *t*, and log-rank tests were used to establish statistical significance.

Results: Overall, 1407 IARs were performed in 1310 patients with CLI by the same surgeon, 705 (50.2%) in 643 diabetic patients and 702 in 667 nondiabetic patients. Autogenous vein conduits were used in 87% of the IARs. There were no perioperative deaths. Diabetic patients had significantly more major (16.7% vs 11.8%; P = .02) and minor complications (9.7% vs 6.5%; P = .02) than nondiabetic patients. At 5 and 10 years, there were no significant differences between diabetic and nondiabetic patients in the rates of primary patency (65% and 46% vs 69.5% and 57%; log-rank test, P = .09), secondary patency (76% and 60% vs 80% and 68%; log-rank test, P = .20), limb salvage (88% and 76% vs 91% and 83%; log-rank test, P = .12) survival (51% and 34% vs 57% and 38%; log-rank test, P = .41), or amputation-free survival (45.5% and 27% vs 51% and 29%; log-rank test, P = .19). The type of conduit did not affect patency or limb salvage rates in either group.

Conclusions: Diabetic patients receiving IAR for CLI can have the same survival and amputation-free survival rates as nondiabetic patients. Their comparable technical and clinical outcomes strongly demonstrate that diabetics with CLI can expect the same quantity and quality of life as nondiabetics with CLI, and aggressive attempts at limb salvage in patients with diabetes mellitus, including distal and foot level bypass grafting, should not be discouraged.

Impact of runoff grade after endovascular therapy for femoropopliteal lesions

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Background: We conceived a new method, runoff grade, to evaluate runoff after endovascular therapy (EVT). We evaluated the validity of using runoff score based on angiographic findings.

Methods: The subjects were 859 consecutive patients (males, 69%; mean age, 73.0 ± 9.0 years) who underwent EVT for de novo femoropopliteal lesions at Kokura Memorial Hospital. We evaluated the postprocedural tibial runoff, named it runoff grade, classified it into 0 through 2, and retrospectively assessed the relationship with the outcome of EVT. Primary, secondary, and assisted primary patency rates and freedom from major adverse limb events (MALE) were compared between runoff grades.

Results: The mean follow-up period was 31 ± 25 months. The lesion length was 91.5 ± 83.0 mm. The rate

of stent use was 52.0%. The primary patency rates at 1, 2, and 3 years were 68.1%, 59.1%, and 53.9%; the secondary patency rates were 90.9%, 88.1%, and 85.9%; the assisted primary patency rates were 79.4%, 72.6%, and 68.5%; and freedom from MALE was 72.5%, 64.8%, and 61.0%, respectively. The primary patency rates at 1, 2, and 3 years were significantly lower in the runoff grade 0 group than in the other groups (55.5% vs 66.7% and 75.6%; 35.8% vs 57.6% and 69.2%; 35.8% vs 53.3% and 60.9% for grade 0, 1, 2, respectively; log-rank, $P < .0001$). Secondary patency rate (78.5% vs 91.8% and 91.8%; 76.3% vs 88.6% and 89.9%; 72.8% vs 86.3% and 88.2%, respectively; $P = .015$), assisted primary patency rate (67.0% vs 78.5% and 85.1%; 56.9% vs 71.6% and 79.3%; 47.6% vs 68.0% and 74.8%; respectively, $P = .0002$), and freedom from MALE (60.8% vs 71.2% and 79.4%; 44.3% vs 64.0% and 72.6%; 36.6% vs 60.7% and 68.5%, respectively; $P < .0001$) were also similar. After adjustment for age, gender, diabetes, hemodialysis, critical limb ischemia, TransAtlantic Inter-Society Consenus II classification, and stent use, runoff grade was an independent predictor of primary patency.

Conclusions: Vessels with runoff grade 0 had significantly worse cumulative outcomes. Our results suggested that runoff grade seemed to play an important role to keep the primary patency.

Gender-specific 30-day outcomes after carotid endarterectomy and carotid artery stenting in the Society for Vascular Surgery Vascular Registry

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Objective: Although the optimal treatment of carotid stenosis remains unclear, available data suggest that women have higher risk of adverse events after carotid revascularization. We used data from the Society for Vascular Surgery Vascular Registry to determine the effect of gender on outcomes after carotid endarterectomy (CEA) and carotid artery stenting (CAS).

Methods: There were 9865 patients (40.6% women) who underwent CEA (n = 6492) and CAS (n = 3373). The primary end point was a composite of death, stroke, and myocardial infarction at 30 days.

Results: There was no difference in age and ethnicity between genders, but men were more likely to be symptomatic (41.6% vs 38.6%; $P < .003$). There was a higher prevalence of hypertension and chronic obstructive pulmonary disease in women, whereas men had a higher prevalence of coronary artery disease, history of myocardial infarction, and smoking history. For disease etiology in CAS, restenosis was more common in women (28.7% vs 19.7%; $P < .0001$), and radiation was higher in men (6.2% vs 2.6%; $P < .0001$). Comparing by gender, there were no statistically significant differences in the primary end point for CEA (women, 4.07%; men, 4.06%) or CAS (women, 6.69%; men, 6.80%). There remains no difference after stratification by symptomatology and multivariate risk adjustment.

Conclusions: In this large, real-world analysis, women and men demonstrated similar results after CEA or CAS. These data suggest that, contrary to previous reports, women do not have a higher risk of adverse events after carotid revascularization.

Platelet inhibition by adjunctive cilostazol suppresses the frequency of cerebral ischemic lesions after carotid artery stenting in patients with carotid artery stenosis

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Objective: Optimal platelet inhibition is an important therapeutic adjunct in patients with carotid artery stenosis undergoing carotid artery stenting (CAS). Clopidogrel resistance is associated with increased periprocedural thromboembolic complications from neurovascular stent placement procedures. The addition of cilostazol to dual antiplatelet therapy (DAT) has been reported to reduce platelet reactivity and to improve clinical outcomes after percutaneous coronary intervention. This study was undertaken to evaluate the impact of adjunctive cilostazol in patients with CAS.

Methods: Platelet function was assessed by light transmittance aggregometry using the VerifyNow assay. Sixty-four consecutive patients who underwent CAS received standard DAT, clopidogrel (75 mg daily), and aspirin (100 mg daily) more than 4 weeks before the procedure. From 2010 to 2011 (period I), 28 patients underwent CAS under standard DAT. From 2011 to 2013 (period II), 36 patients prospectively had preoperative assessment of platelet function, and 13 patients with clopidogrel resistance received adjunctive cilostazol (200 mg daily) in addition to standard DAT. The incidence of new ipsilateral ischemic lesions on diffusion-weighted imaging a day after CAS and ischemic or hemorrhagic events within 30 days was assessed.

Results: Clopidogrel resistance was indentified in 12 patients (43%) in period I and 13 patients (36%) in period II ($P = .615$). In period II, the addition of cilostazol significantly decreased P2Y12 reaction units and % inhibition ($P = .006$ and $P = .005$, respectively), and there was a significant difference in P2Y12 reaction units between the two periods. New ipsilateral ischemic lesions were significantly decreased in period II (2/36 patients) compared with period I (7/28 patients; $P = .034$); however, there was no significant difference in hemorrhagic and thromboembolic events between the two periods.

Conclusions: Adjunctive cilostazol (triple antiplatelet therapy) in clopidogrel-resistant patients reduces the rate of clopidogrel resistance and suppresses new ischemic lesions without hemorrhagic complications, as compared with standard DAT. Antiplatelet management based on the

evaluation of antiplatelet resistance would be required for prevention of perioperative thromboembolic complications in CAS.

Intravascular ultrasound as a clinical adjunct for carotid plaque characterization

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Objective: Virtual histology intravascular ultrasound (VH IVUS) is valuable for estimating minimal lumen diameter and plaque characterization. The clinical use of IVUS in carotid intervention is not well characterized. We aim to evaluate the role of IVUS in carotid plaque characterization and determine whether it could be predictive of procedure-related microemboli.

Methods: From July 2010, patients with severe carotid stenosis who underwent elective carotid stenting procedures were prospectively enrolled. IVUS evaluation was performed before stent placement. Patient demographics, comorbidities, and preoperative images were recorded. Comparison of pre- and postoperative diffusion-weighted magnetic resonance images was used to identify the number of procedure-related microemboli. IVUS-derived minimal lumen diameter and vessel wall plaque characteristics were collected. Univariate and multivariate logistic regressions were used to search for associations between IVUS-derived VH data and incidence of microemboli.

Results: A total of 38 high-risk patients receiving carotid stenting were enrolled. Among them, 25 patients had type I aortic arches and 17 of the patients were symptomatic (preoperative stroke or transient ischemic attack). VH IVUS data did not show strong associations with microemboli, however, a trend was found between the area of fibrous tissue and median or more incidence of microemboli (P = .099). IVUS-defined vessel diameter maximum was associated with median or more incidence of microemboli (P = .042). In addition, median or more incidence of microemboli showed trends with proximal common carotid artery calcification (P = .056) and with being over the age of 80 (P = .06). Contralateral carotid occlusion or high-grade stenosis was associated with postoperative contralateral microemboli (P = .036).

Conclusions: We demonstrate that periprocedural carotid IVUS is clinically feasible. VH IVUS may be helpful in better understanding plaque morphology and determining optimal stent placement. However, its use in predicting microembolization remains limited.